THE DEVELOPMENT OF PROCEDURES FOR SAFETY AUDIT OF TRAFFIC CONTROL AT ROADWORK SITES

Author: Jeff Kaye, National Highway Safety Manager, Opus International Consultants Ltd, P O Box 1482, Christchurch, NEW ZEALAND

1. INTRODUCTION

The main incentive for development of the audit procedures is the number and severity of crashes at roadworks sites. The Land Transport Safety Authority (LTSA) has analysed crash data in New Zealand for 1996 and their report states, amongst other things, "that crashes at roadworks sites are more frequently fatal crashes when compared to the average traffic crashes in New Zealand". The fatality rate for this type of crash, is three times the national rate. In 1996, 213 crashes were reported at roadworks sites, with a cost to the nation of $19 million.

Additionally, Transfund New Zealand (Transfund NZ) currently carries out a number of Network Safety Audits of Existing Roads each year. On all audits of this type carried out to date, traffic control at roadworks sites, was identified as a significant safety defect.

2. PILOT SAFETY AUDIT OF TRAFFIC CONTROL AT ROADWORKS SITES

In 1997 a pilot audit was proposed. This audit was an unannounced, one day study, carried out in the Wellington/Wairarapa Road network area, where sites were chosen on a random basis. The purpose of the audit was to determine if the problems were potential or "real". The results of the audit are shown in the table below:

Hazard Category	Number of Sites
Satisfactory	0
Marginal	10
Serious	3
Critical	2

To some extent, these results, confirmed the problem to be real.

In 1998, two 2-day unannounced audits of road networks were carried out in the Northern Canterbury and the Auckland North areas. The results of these audits are shown in the table below:

Hazard Category	Number of Sites
Satisfactory	0
Marginal	20
Serious	10
Critical	29

These results confirmed that a significant number of the sites audited fall into the serious and critical categories. In the case of those in the critical category, the sites presented a serious hazard and the work should cease and the sites be made safe immediately.

3. THE INTERIM PROCEDURES FOR SAFETY AUDIT OF TRAFFIC CONTROL AT ROADWORKS SITES

Following a debrief of the teams involved in the pilot audits, Transfund NZ decided to proceed with the further development of audit procedures.

These procedures have been written for an independent audit team, that is commissioned to investigate a number of sites over a period of some days and where the audit is not announced to the Road Controlling Authority. However, the procedures can be adapted to be used for announced audits and audits of single sites. The procedures contain the administrative details regarding setting up, how to undertake and report on an audit of this type. This paper will concentrate on the inspection methodology.

3.1 Inspection Method

The audit inspections carried out to date have used an unmarked van, being driven in the manner of a "normal" road user.

The driver is always a member of the team who is not familiar with the road network. The team of four, drive through the site three times. On the first drive through, the team records the location, the Road Controlling Authority, the Contractor and the type of work being undertaken. The site is also videoed. At the completion of the first drive through, a sketch of the site is started and a checksheet filled in. The second drive through is carried out in the opposite direction, making and recording the same observations. The layout sketch of the main route is completed. The third drive through the site is undertaken to check the details on any side roads and to record any specific items of concern. At the completion of the third drive through, the layout sketches are completed, details of the site completed and the team agrees on the "Site Hazard Rating" (SHR) before leaving the site. A description of the rating system follows.

3.2 Site Hazard Rating

The Site Hazard Rating (SHR) evolved during the pilot audits. It is a method of determining how relatively safe the site actually is, and is generally based on the results of audits undertaken to date and the actions required at these sites to make then "safe". The SHR is composed of three components that are multiplied together. These are - The Site Condition Factor, The Site Complexity Factor and The Traffic Effects Factor.

3.2.1 Site Condition Factor

The Site Condition Factor considers "compliance" with good practice with regard to the traffic control equipment and how it is installed at the site. Each element of non-compliance is given a number that reflects its component importance with regard to temporary management of the traffic. The defects observed are tallied by occurrence and summed to give the Site Condition Factor.

3.2.2 Site Complexity Factor

The Site Complexity Factor reflects the risk and exposure, by examining the type of road, traffic volume, the presence of intersections, cyclists and pedestrians. The numbers allocated reflect the potential for and likely severity of crashes occurring on this section of road.

3.2.3 Traffic Effects Factor

The Traffic Effects Factor examines the change to the normal operating condition of the road and reflects the risks that road users are exposed to, with regard to the way they are required to pass the site. The numbers are allocated on the basis of deflection from the normal travel path.

3.2.4 Calculation of the Site Hazard Rating and Hazard Category

The SHR is the product of the above three factors. The numbers are abstract and have no inherent meaning, other than to slot the hazard presented, at each site, into an appropriate hazard category.

The categories are:

- **SHR - 0-300** **Satisfactory**
- **SHR - 301-1500** **Marginal**
- **SHR - 1501-2500** **Serious**
- **SHR - plus 2501** **Critical**

The SHR and the categories are a pragmatic approach, based on the experience and judgement of the pilot audit team members. This is not based on any scientific theory or statistical analysis.

3.3 Promulgation of the Interim Procedures

Transfund NZ commissioned the production of the "Interim Procedures for the Safety Audit of Traffic Control at Roadwork Sites". The procedures were released in February 1999 with a copy being issued to every Road Controlling Authority, the Land Transport Safety Authority and the NZ Police. The procedures were introduced to the NZ roading industry at a series of nine seminars held throughout the country. These seminars were attended by in excess of 720 representatives of Contracting Industry, Consultants, Service Authorities and Road Controlling Authorities.

4. WHO CAN USE THE PROCEDURES?

The procedures can be used by a number of organisations, such as Road Controlling Authorities, Consultants, Service/Utility Authorities and Contractors to audit/review their own performance.

The procedures have been written, for team audits of a Road Network, where up to 30 sites can be inspected in 2 days. They can be adapted for audits of a shorter duration with a smaller team.
The procedures can also be used for: -

- One or two person audits of a single site.
- Either announced or unannounced audits.
- Audit of active sites.
- Audits of unattended sites
- Both during daytime and nighttime audits.

5. TESTING OF THE INTERIM PROCEDURES

5.1 Day Time and Night Time Audits

Following the release of the procedures, Transfund NZ commissioned a two day audit of sites in the Waikato area. This was an announced audit and was undertaken to test the ability of the procedures for use during night audits. The same sites in the Waikato area were audited during the day and night. The results are shown in the following table:

Hazard Category	Day	Night
Satisfactory	1	2
Marginal	0	0
Serious	4	5
Critical	7	5

Essentially, there was not a lot of difference in the SHR's between day and night, although the reasons for the rating may have changed from day to night. However, overall the same pattern of hazard rating remained relatively unchanged.

5.2 High Capacity Highways Audits

Transit New Zealand has commissioned a number of audits, using the procedures, looking at the hazards presented by roadworks on High Capacity Highways in the Auckland Region. These audits included both motorways and two lane, two way highways. The results are shown in the table below:

Hazard Category	Motorways (HCH)	Highways (HCH)
Satisfactory	0	0
Marginal	1	2
Serious	1	5
Critical	3	6

This shows a similar pattern to previous audits where half the sites inspected fall into the Critical hazard category. It is worth noting that HCH roads by definition are high volume, high speed roads. This means that the Site Complexity Factor will generally attract a higher rating, and if the lane availability is reduced, the Traffic Effects Factor will also be high. This means that a site that has only a few minor defects, relating to signs and delineation, can result in a SHR rating that is "Serious" or even "Critical". This, however, reflects the risk to road users and site workers at the type of site.

5.3 Repeatability

A recent audit was carried out in the Hutt City Council area, on four sites both during the day and at night. During this audit the same sites were inspected, by two independent audit teams, with the first team (Team 1) following the second team (Team 2) through each site.

The purpose of this exercise was to test the repeatability of the procedures – would both teams get the same result (SHR) at each site. The results of this audit are shown in the table below:

Site No.	Team 1		Team 2		Hazard Category
	SHR Day	SHR Night	SHR Day	SHR Night	
1	610	680	490	890	Marginal
2	1950	1005	1250	935	Marginal
3	966	690	925	1010	Marginal
4	3480	-	3840	-	Critical

Generally both teams got the same results for each site. The exception was the Site No 2 Day Time audit results. On examination of the audit, video and recorded results, it was clear that the site had changed in the time between Team 1 and Team 2's inspection of the site. Although only tested on a small number of sites, the indications are that the audits are repeatable. This means that different teams should get the same results.

6. SIGNIFICANT FINDINGS TO DATE (Common Defects)

- Approach layouts are often obstructed by parked vehicles.
- Approach warning signs are often not visible to approaching traffic.
- Considering the total site, no speed restrictions were enforceable by law, due to lack of complete signage, sign spacing and/or reinstatement of the posted speed limit.
- Over half of the side roads audited had no signs installed to warn of road users of the works on the main route.
- Many sites had no delineation devices installed. If these were installed, spacing between devices was inadequate. Approach tapers were either non-existent or too short.
- The end of works zone was almost always inadequate and poorly installed.
- Personal safety was a problem with both equipment and personnel working in live lanes, excavations poorly protected, no alternative provisions for pedestrians and cyclists and workers not wearing high visibility clothing.
- On some construction sites, work was being undertaken in the "live line", with no separation between construction equipment and road users.

7. WHERE TO FROM HERE

Transfund NZ have issued the methodology as interim procedures and welcome any feedback.

Following the release of the interim procedures, many industry representatives have adopted the concept of this type of audit.

Transit NZ, the State Highway Road Controlling Authority, have recently asked that all Network Management consultants and Capital works project consultants in New Zealand undertake regular audits of their contractors worksites. These audits are to include both maintenance and project works. Transit NZ are recommending that methodology contained in the Interim Procedures is used for these audits and in particular the SHR check sheets.

The results to date indicate that traffic control at roadwork sites must be improved.

By identifying defects and the hazards associated with roadwork sites, the quality of sites should improve. The risks, therefore, should be reduced. Sites will be more consistent from a road user's point of view. The combination of the above should result in a reduction in the number and severity of crashes at roadworks sites. The possibility of litigation and site closure will also be reduced.

The procedures appear to be robust and to give consistent results.

8. REFERENCES

- Transfund New Zealand Review and Audit Division Report – RA 98/689S "Interim Procedures for the Safety Audit of Traffic Control at Roadwork Sites", February 1999.

- Transfund New Zealand Review and Audit Division Report – RA 98/699S "Pilot Safety Audit of Traffic Control at Roadwork Sites : Summary Report", February 1999.

9. ACKNOWLEDGEMENTS

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